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Title: *Deceleration of Helium ions in the Solar Wind*

Cluster: *Cross-Theme Theory and Data Analysis/SECTP*

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• A mechanism shown capable of decelerating heavy ions in the solar wind.

In the high speed solar wind, He^{++} and other minor ion species stream faster than the dominant protons. The average observed speed of the He^{++} ions is near and below the local Alfven speed (V_A) relative to the protons. With increasing distance from the sun V_A decreases, as does the streaming He^{++} speed relative to V_A. The source of this deceleration of the heavy ions has been a long-standing problem. Instability of the streaming helium ions has been suggested as a cause, but is problematic because the required instability threshold speed can be well above the observed speed. Recent hybrid model simulations of the plasma, made at U.N.H., show that Alfven waves and imbedded abrupt changes of the magnetic field (i.e., rotational discontinuities), which are known to pervade the fast solar wind, can produce the deceleration of the He^{++} ions. When the He^{++} ions stream at speeds greater than V_A relative to the protons the modeled relative speed decreased to speeds below V_A, consistent with observations.

This study was made by a doctorial candidate who received an outstanding student paper performance for his poster presentation on the subject at the Spring 2001 American Geophysical Union Meeting. Support of this research by the SECTP program has not only resulted in the production of a new capable scientist, but has also led to a new understanding of solar wind measurements and provides direction for future studies of solar wind dynamics.

HYBRID SIMULATION
(Single particle analysis of protons and He^{++} with a quasi-neutralizing electron fluid background)

From: "The interaction of Alven particles with Alfven waves and imbedded rotational discontinuities", Kaghashvii, E, and Vasquez, B. J., paper SH41B-15, AGU Spring Meeting, Boston MA, 2001.